TRAILER HAVING TILT AND DUMP FUNCTIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims domestic priority on U.S. Provisional Patent Application Serial No. 60/268,448, filed Feb. 13, 2001, the contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

This invention relates generally to a trailer attachable to a vehicle and, more particularly, to a trailer configured to provide selectively an operation of tilting about its tire axis and an operation of dumping about a dump axis positioned rearwardly of the tire axis.

Trailers have been designed to provide the ability to tilt or to provide the ability to dump. A trailer that tilts generally has an articulated tongue that, when released to articulate about a generally transversely extending horizontal axis, allows the trailer to pivot about an axis corresponding to the center of the trailer tires, which if mounted coaxially on the trailer axle would correspond to the trailer axle, thus allowing the rearward end of the trailer to lower to the surface of the ground and permit convenient access to the trailer bed. Tilting is typically used to load other wheeled devices onto the trailer bed. Since the rearward end of the trailer bed is positionable adjacent the surface of the ground, a wheeled device such as a wheeled utility vehicle, a motorcycle, or a wheeled hand cart, can easily roll onto the trailer bed. Movement of the tilt function of such trailers is typically accomplished manually by releasing a locking device fixing the bed frame to the trailer tongue to permit the tongue to pivot relative to the bed frame and allow the bed frame to pivot about the tire center. Returning the trailer bed to a transport position with the bed frame fixed to the trailer tongue is typically a matter of balancing the load on the trailer bed relative to the tires to permit the bed frame to be pivoted back into position to be locked to the trailer tongue.

A dump trailer is also known in the art. Dump trailers are configured to pivot the trailer bed about a dump axis carried by the dump frame with the dump axis being located near or at the rearward end of the trailer bed. When the trailer bed is moved into a dump position, the rearward end of the trailer remains elevated above the ground while the forward end of the trailer bed is raised to urge any load on the trailer bed to slide off the bed onto the ground. The dump function is usually not accomplished manually. The movement of the bed frame carrying the trailer bed relative to the dump frame is typically accomplished through a dump actuator that is sufficiently powerful to raise the trailer bed and load thereon. This dump actuator is normally positioned underneath the trailer and is effective to cause a vertical movement of the trailer bed about the rearwardly positioned dump axis. To provide this known dump actuator configuration for a small towed trailer would require that the actuator be remotely powered and that the trailer structure provide sufficient depth to house and protect the dump actuator.

It would be desirable to provide a trailer capable of being towed behind a conventional vehicle, such as a truck or a car, that would be operable to provide both a tilt function and a dump function. It would also be desirable to provide a compact actuator mounting that would be effective to provide the dump function in a manner that would overcome the disadvantages of known dump actuators. It would also be desirable to provide a trailer and actuator configuration that would be conducive to being manually operated without requiring a remote power source.

SUMMARY OF THE INVENTION

It is an object of this invention to overcome the disadvantages of the prior art by providing a trailer having both dump and tilt functions.

It is another object of this invention to provide a trailer having an actuator operable to effect a tilting and dumping operations for the trailer.

It is a feature of this invention that the trailer is provided with a frame configuration that is connected to the tongue of the trailer and supports a bed frame to provide a dump frame configuration.

It is another feature of this invention that the trailer bed is selectively pivotable about a transverse axis corresponding to the axis of rotation of the wheels to provide a tilt feature for the trailer and about a transverse axis located at the rear portion of the trailer to provide a dump feature for the trailer.

It is an advantage of this invention that the same actuator can provide both tilt and dump functions for the trailer.

It is still another feature of this invention that the selection between the tilt and dump operations of the trailer can be selected by disconnecting or unlatching the articulated tilt frame from the tongue or by disconnecting or unlatching the bed frame from the articulated tilt frame.

It is still another object of this invention to provide a mounting for the actuator that will enable the actuator to perform both tilt and dump operations for the same trailer while being capable of being stowed into an inoperative transport position.

It is still another feature of this invention that the actuator can be pivoted about the connections thereof with the bed frame and the tongue of the trailer to be lowered into an inoperative transport position substantially parallel with the tongue of the trailer.

It is still another advantage of this invention that the actuator can be pivoted to a position that lies entirely below the plane of the surface of the trailer bed.

It is yet another object of this invention to provide an actuator that can be manually powered or may be driven by a remote power source.

It is yet another object of this invention to provide an actuator that can be installed as a kit for existing dump or tilt trailers to provide a power apparatus for accomplishing the pivotal movement of the trailer.

It is still another advantage of this invention that the actuator can be selectively configured for operation in a power mode or in a free mode in which the actuator does not interfere with the gravity operation of the trailer to tilt.

It is yet another feature of this invention that a latch mechanism is provided to control the pivotal movement of the actuator between a raised operative position and a lowered inoperative transport position.

It is yet another object of this invention to provide a trailer operable to provide both tilt and dump functions which is durable in construction, inexpensive of manufacture, carefree of maintenance, facile in assemblage, and simple and effective in use.

It is a further object of this invention to provide an actuator that can provide powered tilt and dump operations for a trailer and be convertible between a raised operative position and a lowered inoperative transport position generally parallel to the trailer tongue.

These and other objects, features and advantages are accomplished according to the instant invention by providing a frame configuration that is particularly adaptable for use on a trailer such that the frame configuration is operable in both a tilt mode of operation and a dump mode of operation. An actuating mechanism includes a linear actuator that is supported on the frame by a bracket and a yoke that connects to a load bed to power the vertical movement of the load bed in both tilt and dump functions. The linear actuator is pivotally mounted to permit a re-positioning of the actuator into an inoperative position. The frame configuration is provided with an articulated tilt frame in which the tongue is pivoted thereto allowing the load bed to pivot about a tilt axis which can coincide with the wheel axis of the trailer. The bed frame can be locked to the tilt frame for tilting upon articulation with the tongue, while a disconnection of the bed frame from the tilt frame enables the bed frame to pivot about the dump axis to provide a dump function in addition to the tilt function. The actuator can pivot about the connection thereof to the bed frame to position the actuator into a lowered inoperative transport position generally parallel to the trailer tongue. A modified screw jack can be part of a kit that can be utilized to provide the powered operations of the tilt function for existing gravity-based tilt trailers.

BRIEF DESCRIPTION OF THE DRAWINGS

The advantages of this invention will become apparent upon consideration of the following detailed disclosure of the invention, especially when taken in conjunction with the accompanying drawings wherein:

FIG. **1** is a schematic right front perspective view of the articulated tilt frame and tongue of a trailer incorporating the principles of the instant invention;

FIG. **2** is a schematic right front perspective view of a trailer bed frame to be mounted on the articulated tilt frame and tongue of the trailer depicted in FIG. **1**;

FIG. **3** is a schematic right front perspective view of a trailer frame assembly incorporating the principles of the instant invention to provide both a tilt function and a dump function for the trailer;

FIG. **4** is a cross-sectional view corresponding to lines **4—4** of FIG. **3** to depict an elevational view of one side of the trailer frame;

FIG. **5** is a schematic right front perspective view of the trailer frame of FIG. **3** with a bottle jack added to provide an actuator for the dump and tilt functions of the trailer frame;

FIG. **6** is a schematic right front perspective view of the trailer frame of FIG. **5** with an optional winch added to the tilt frame forwardly of the bottle jack;

FIG. **7** is an enlarged side elevational detail view of the bottle jack;

FIG. **8** is a front elevational view of the bottle jack depicted in FIG. **7** with a remote power option being depicted;

FIG. **9** is an enlarged front elevational view of the bottle jack shown in FIG. **5**, the trailer bed frame being represented by the mounting members, the remainder of the trailer frame being deleted for purposes of clarity;

FIG. **10** is a side elevational view of the mounting of the bottle jack depicted in FIG. **9**, the bottle jack being shown in an upright operative position;

FIG. **11** is a side elevational view similar to that of FIG. **10** but with the bottle jack being lowered into a horizontal inoperative position on top of the tongue;

FIG. **12** is a top plan view of the bottle jack, tongue and front portion of the trailer frame shown in FIG. **11**;

FIG. **13** is a schematic side elevational view of the trailer incorporating the principles of the instant invention and depicting both the tilt function and the alternate dump function of the trailer relative to a normal transport position;

FIG. **14** is a side elevational view similar to that of FIG. **10**, but depicting an alternative trailer bed lift jack arrangement utilizing a cable lift system;

FIG. **15** is a schematic side elevational view of the trailer moved into a dump position by the alternative trailer bed lift jack and cable lift system of FIG. **14**;

FIG. **16** is front elevational view of a screw jack actuator operable to provide an assist to the tilt function of existing gravity-based tilt trailers, the trailer bed frame being represented by the mounting members, the remainder of the trailer frame being deleted for purposes of clarity;

FIG. **17** is a side elevational view of the latch mechanism for the screw jack actuator corresponding to lines **17—17** of FIG. **16**; and

FIG. **18** is a cross-sectional view of the screw jack actuator corresponding to lines **18—18** of FIG. **17** to depict a top plan view of the latch mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. **1–6** the details of a trailer frame incorporating the principles of the instant invention can best be seen. Any references to left and right are used as a matter of convenience and are determined by standing at the rear of the trailer and facing the hitch to be connected to a vehicle, which would be the normal direction of travel of the trailer. The trailer **10** has a tongue **12** provided with a hitch **13** located at the forward terminus of the tongue **12** to connect in a known manner to a vehicle, such as a truck or a car to provide motive power for the movement of the trailer **10** over the surface of the ground G. The forward end of the tongue **12** can also be provided with a conventional support jack (not shown) to keep the hitch **13** at a convenient height when disconnected from any vehicle. The trailer **10** also includes an axle **15** on which tires **16** can be directly mounted on or, as is depicted in the drawings, to which tires **16** can be mounted through a pair of laterally opposed suspension arms **18**. The tires **16** are rotatable about the spindles **17** allowing the trailer **10** to be movable over the ground G in a conventional manner. The transversely extending spindles **17** also defines a tilt axis **19**, as will be described in greater detail below.

The tilt frame **20** can best be seen in FIG. **1**. The tilt frame **20** is preferably formed in an "A-frame" configuration and is rigidly connected to the axle **15** by mounting flanges **21**. A rear transverse support member **23** defines a dump axis **29**, to be described in greater detail below, and carries support brackets **24** pivotable about the dump axis **29** for attachment of the trailer bed frame **30**. A front transverse member **25** carries a pivot bracket **26** for pivotally connecting the tongue **12** for articulation about a horizontal articulation axis defined by the pivot bracket **26**. The side rails **22** of the tilt frame **20** converge to meet at a lock bracket **27** that is positioned in register with the tongue **12** so that a removable fastener **27*a*** (best seen in FIGS. **1, 3, 5, 6, 11** and **12**) can fix the apex of the tilt frame **20** to the tongue **12** and prevent any articulation of the tongue **12** relative to the tilt frame **20** about the pivot bracket **26**. Diagonally oriented support struts **28**, interconnecting the laterally spaced ends of side rails **22** and the center of the front transverse member **25**,

provide rigidity for the tilt frame **20**. The converging side rails **22** each have a locking tab **22***a* welded on the inside. The locking tabs **22***a* are alignable with the mounting members **36** on the trailer bed frame **30**, for reasons to be described in greater detail below.

The trailer bed frame **30** can be seen best in FIG. **2** depicted as an independent structure. The trailer bed frame **30** has a pair of laterally spaced side rails **32** that are positionable above the side rails **22** of the tilt frame **20**. The side rails **32** of the bed frame **30** are formed with holes **33** for detachable connection by fasteners (not shown) to the support brackets **24**. As a result, the trailer bed frame **30** is pivotable about the dump axis **29**. The rearwardmost transverse frame member **34** is, therefore, positioned rearwardly of the rearward transverse frame member **23** of the tilt frame **20**. Accordingly, any pivotal movement of the trailer bed frame **30** about the dump axis **29** will result in the rearwardmost transverse frame member **34** of the trailer bed frame **30** dropping closer to the ground, while the rearward transverse frame member **23** of the tilt frame **20** maintains its normal elevation above the ground.

The trailer bed frame **30** further includes a forwardmost transverse frame member **35** provided with forwardly projecting mounting members **36** for connecting to the bottle jack **40**, as will be described in greater detail below. The mounting members **36** are positioned for alignment with the locking tabs **22***a* to permit the trailer bed frame **30** to be selectively locked to the tilt frame **20**. A tongue bracket **38** is fixed to the forwardmost transverse frame member **35** and to the second transverse frame member **37** and is positioned to surround the tongue **12** when the trailer bed frame **30** is positioned on top of the tilt frame **20** in its normal operating configuration. Central traverse frame members **31** are positioned between the second traverse frame member **37** and the rearmost traverse frame member **34** so that the trailer bed frame **30** will support planking or the like (not shown) to provide a trailer bed in a manner known in the art.

Referring now to FIG. **3**, the trailer frame **11** can best be seen. The trailer bed frame **30** is mounted on top of the tilt frame **20** with the side rails **32** connected to the support brackets **24** for pivotal movement about the dump axis **29**. Removable pins (not shown) interengage the locking tabs **22***a* and the mounting members **36** to keep the trailer bed frame **30** locked to the tilt frame **20**. Alternatively, the locking tabs **22***a* can be formed with upwardly extending locking pins (not shown) that align with holes through the mounting members **36** which can then be locked into place by click pins, cotter pins, hair pins or the like. The bottle jack mounting brackets **57** are also shown in FIG. **3** connected to the tongue **12** forwardly of the tongue bracket **38** and rearwardly of the lock bracket **27**. The details of the bottle jack mounting brackets **57** are better seen in FIGS. **9–12** and are described below. The configuration shown in FIG. **3** is the normal operating position in which the trailer **10** can be towed along the public highway carrying a load without the capability of either tilting or dumping unless reconfigured as described in greater detail below.

The elevational details of the trailer frame **11** can best be seen in the cross-sectional view of FIG. **4**. The trailer bed frame **30** is positioned on top of the tilt frame **20**. The transverse bed frame members **31, 34, 35** and **37** have different thicknesses, as are represented by the lines shown in FIG. **4**. All of the transverse frame members **31, 34, 35, 37** of the trailer bed frame **30** terminate in a common plane forming the top surface of the trailer bed frame **30** so as to provide a planar surface **39** on which to mount the planking forming the bed (not shown) of the trailer **10**. The forwardmost transverse frame member **35** and the second transverse frame member **37** have a thickness that terminates just above the side rails **22** of the tilt frame **20**. The central traverse frame members **31** have smaller cross-sections and greater clearance above side rails **22**. The rearwardmost transverse frame member **34** has the largest cross-sectional configuration as there is no primary frame component immediately beneath the frame member **34**. The mounting flanges **21** are depicted as interconnecting the side rails **22** of the tilt frame **20** and the axle **15**. The side rails **32** of the trailer bed frame **30** nest over top of the mounting flanges **21** just outboard of the side rails **22** of the tilt frame **20**.

FIG. **5** depicts the mounted location of the bottle jack **40**, connected to the bottle jack mounting brackets **57** affixed to the tongue **12**. The details of the bottle jack **40** and the relationship thereof to the trailer frame **11** will be described in connection with FIGS. **7–12** below. One skilled in the art will recognize that the bottle jack **40** is depicted in FIG. **5** in a normal operating position, capable of lifting the trailer bed frame **30** relative to the tilt frame **20** about the dump axis **29**. While the bottle jack **40** is preferred because of its simplicity and economy, other hydraulic or electric actuators could also be substituted equally for the bottle jack **40**. In FIG. **6**, an optional winch **14** is depicted as being mounted on the tilt frame **20** forwardly of the bottle jack **40**, preferably mounted on the lock bracket **27**. Preferably, the winch **14** is formed with bolts or connectors (not shown) depending downwardly therefrom to engage slots (not shown) formed in the lock bracket **27** that can receive the bolts (not shown) to provide a quick-attach system for the winch **14**. The winch **14** must be detachable to permit the bottle jack **40** to be reclined into an inoperative horizontal position, as will be described in greater detail below. The winch **14** can be operable with the bottle jack **40** in the upright position as the cable can pass between the bottle jack **40** and the legs **52** of the yoke **50**.

An extended stroke bottle jack **40** is depicted in FIGS. **7** and **8**, with modifications to provide a more convenient pressure release valve **42**, an integral pump handle **45** and an optional fitting **44** for connection to a remote power source. The bottle jack **40** includes a handle **45** for pumping hydraulic fluid from an internal reservoir into the conventional operative internal chambers of the bottle jack **40**, causing the tip **46** at the distal end of the bottle jack **40** to extend upwardly. Manipulation of the pressure release valve **42** will allow the hydraulic fluid to return to the internal reservoir and permit the tip **46** to contract back to the housing **41**. The base **47** of the bottle jack **40** includes a clevis **48** adapted for pivotal connection to a support member, which in this configuration would be the tongue **12** in a manner described below. Preferably, the bottle jack **40** will be equipped with an optional fitting **44** that will allow the bottle jack **40** to be connected to a remote hydraulic system, such as on a tractor or the like (not shown), for operation thereof in lieu of the manipulation of the pump handle **45** and pressure release valve **42**. The release valve **42** will preferably be adapted to extend to a greater height above the base **47** to permit a convenient operation without requiring the operator to place his hands into the area of moving frame components.

The mounting of the bottle jack **40** is best seen in FIGS. **9–12**. The clevis **48** is mounted by a pivot bolt **49** to a pair of upright links **58** pivotably supported on hubs **58***a* mounted in the bottle jack mounting brackets **57** and positioned on opposing sides of the tongue **12**. The upright links **58** transfer the load exerted on the bottle jack **40** through the hubs **58***a* to the bottle jack mounting brackets **57** and, therefore, to the tongue **12**. A pivot control quadrant **55** fixed

to the base 47 of the bottle jack 40 on each side of the tongue 12 is also mounted on the pivot bolt 49 for pivotal movement in concert with the base 47 of the bottle jack 40. The quadrants 55 extend vertically below the tongue 12 and restrain the bottle jack 40 in pivotal relationship with upright links 58 by a restraining pin 56 interengaging the quadrants 55, the upright links 58 and the bottle jack mounting brackets 57 beneath the tongue 12. As shown in FIGS. 9 and 10, the axes of the pivot bolt 49, restraining pin 56 and bottle jack 40 are secured in a common plane.

A yoke 50 has an elevated bight portion 51 connected to the tip 46 by a fastener (not shown). A pair of legs 52 extend downwardly from the bight portion 51 for pivotal connection to the mounting members 36 projecting forwardly from the forwardmost transverse frame member 35 of the trailer bed frame 30. The pivot axis 53 passes through the pivotal connection between the legs 52 of the yoke 50 and the mounting members 36, the axis of bottle jack 40 and approximately concentrically through the pivot bolt 49 fastening the clevis 48 of the bottle jack 40 to the upright links 58. The upright alignment of the bottle jack 40 follows the upward movement of the trailer bed reflecting the upward movement of the pivot axis 53 passing through the pivotal connection between the legs 52 and mounting members 36. The upright links 58 are pivotable with the quadrants 55 about the restraining pin 56 defining the pivot axis carried by the bottle jack mounting brackets 57. The bight portion 51 is rigidly fastened to the tip 46 of the bottle jack 40 so the extension of the tip 46 from the bottle jack 40 raises the yoke 50 and the connected trailer bed frame 30.

Particularly since the bottle jack 40 is of a construction that extends upwardly a substantial distance above the tongue 12, the bottle jack 40 in the upright operative position can be in the way of the loading some materials onto the trailer bed (not shown). Accordingly, it would be desirable to provide a mechanism for allowing the bottle jack 40 to be moved into a non-intruding inoperative position in such circumstances. The mounting apparatus described above provides such a mechanism. When the bottle jack 40 is desired to be moved into a lowered inoperative position, the restraining pin 56 is removed from engagement with the pivot control quadrants 55, upright links 58 and the bottle jack mounting brackets 57 to allow the bottle jack 40 and the affixed pivot control quadrants 55 to pivot about the pivot bolt 49. The connected yoke 50 will also pivot on its respective connection to the mounting members 36 about the concentric pivot axis 53 to allow the entire bottle jack 40 and connected yoke 50 to be lowered to a horizontal position on top of the tongue 12, as is depicted in FIGS. 11 and 12.

While lowering bottle jack 40 and the connected yoke 50, a limited amount of misalignment between pivot bolt 49 and pivot axis 53 can be accommodated as the upright links 58 can pivot relative to the bottle jack mounting brackets 57. Furthermore, strain within the legs 52 will allow the axis of bottle jack 40 to slightly misalign with the pivot axis 53. A reinstallation of the restraining pin 56 into aligned quadrant holes 59 and through the upright links 58 and the bottle jack mounting brackets 57 will retain the bottle jack 40 and attached yoke 50 in the lowered position. One skilled in the art will readily recognize that the optional winch 14, if installed on the tongue 12, would have to be removed before the bottle jack 40 and yoke 50 could be lowered to the inoperative transport position.

Referring now to all the drawings, but particularly the schematic multi-positional drawing of FIG. 13, the operation of the trailer 10 in both the tilt and dump functions can be seen. Referring first to the tilt position 60 of the trailer 10, the operator must remove the fastener device 27*a* (best seen in FIGS. 1, 3, 5, 6, 11 and 12) interengaging the lock bracket 27 and the tongue 12 to permit the tongue 12 to articulate about its pivotal connection with the pivot bracket 26. Since the trailer bed frame 30 is still fixed to the tilt frame 20 by virtue of the pins connecting the locking tabs 22*a* to the mounting members 36, the trailer bed frame 30 will tilt with the tilt frame 20 about the tilt axis 19 defined by the spindles 17. The tip 46 of the bottle jack 40 is free to extend from the housing 41, thereby allowing the yoke 50 to move upwardly with the mounting members 36 to which it is attached. The bottle jack 40 is pivotable on the hubs 58*a* supporting the upright links 58 on the bottle jack mounting brackets 57, allowing the bottle jack 40 to rotate rearwardly to accommodate the upward and rearward movement of the mounting members 36. Once the trailer 10 is returned to the normal home position, the fastener 27*a* can be re-engaged between the lock bracket 27 and the tongue 12.

Re-configuring the trailer 10 to permit the dump function to operate requires the removal of the pins (not shown) interconnecting the locking tabs 22*a* and the mounting members 36, thereby releasing the trailer bed frame 30 for pivotal movement relative to the tilt frame 20 about the dump axis 29 for the positioning thereof in a dump position 61, shown in FIG. 13. To force the raising of the trailer bed frame 30, the bottle jack 40 can be pressurized by stroking the pump handle 45, or by connecting the optional fitting 44 to a remote source of hydraulic power, resulting in an extension of the tip 46 from the housing 41. The attached yoke 50, the legs 52 of which extend downwardly for connection to the mounting members 36, then rises with the tip 46 and draws the forwardmost transverse frame member 35 of the trailer bed frame 30 upwardly, rotating about the dump axis 29 carried by the rear transverse frame member 23 of the tilt frame 20. As with the tilt function above, the bottle jack 40 is pivotable about the hub connection 58*a* between upright links 58 and the bottle jack mounting brackets 57 to allow the bottle jack to rotate rearwardly to accommodate the upward and rearward motion of the forwardmost transverse frame member 35 as it pivots about the dump axis 29.

Referring now to FIGS. 14 and 15, an alternative trailer bed lift jack assembly 70 can best be seen. A jack support 71 is fixed to the top of the tongue 12, preferably by welding. The assembly 70 includes a jack post 72 fixed to the base 47 of the hydraulic jack 75 to elevate the base 47 of the hydraulic jack 75 above the tongue 12 a sufficient distance to locate a lower pulley 73 rotatably mounted on the jack post 72 at a position forwardly of the centerline of the lift jack assembly 70. The jack post 72 is pivotally connected to the jack support 71 by a pivot pin 74. A rod extension 76 is fixed to the tip 46 of the hydraulic jack 75 to rotatably mount an upper pulley 77 at a position spaced above the tip 46. The rod extension 76 also provides a cable mount 78 to which is affixed the end of a cable 79 that is entrained around the lower pulley 73, then entrained around the upper pulley 77 and connected to the trailer bed frame 30.

The front wall of the trailer 10 is provided with a cam track 80 that is centrally mounted above the tongue 12 in register with the upper pulley 77. The cam track 80 is preferably formed as a reinforced leg channel configured in a "C-shape" so as to allow the cable 79 to pass into the cam track 80, but not the upper pulley 77 which rides on top of the cam track 80. The base of the cam track 80 is supported by the trailer bed frame 30 and provides the connection point for the distal end of the cable 79 for lifting the trailer bed in a manner to be described in greater detail below. Both the

lower and upper pulleys 73, 77 and the pivot pin 74 between the jack post 72 and the jack support 71 are offset from the centerline of the lift jack assembly 70, the pulleys 73, 77 being offset forwardly of the centerline and the pivot pin 74 being rearwardly of the centerline, to reduce the bending moment on the piston of the hydraulic jack 75 and the moment urging the lift jack assembly 70 against the cam track 80 since two strands of the cable 79 are rearward of the hydraulic jack 75 and one strand is forward thereof.

The cam track 80 provides a track against which the upper pulley 77 rides as the trailer bed is being raised by the action of the lift jack assembly 70. The cam track 80 prevents the lift jack assembly 70 and the third strand 83 of the cable 79 from rubbing against the bottom corner of the trailer bed. Preferably, the cam track 80 is detachable and is supported on a cam support 85 by a pin 84 that also attaches the cable 79 to the trailer bed frame 30. Removal of the connecting pin 84 and the pivot pin 74 enables the entire lift assembly 70 and cam track 80 to be removed from the trailer 10.

Operation of the lift assembly 70 effects a multiplication of the stroke of the hydraulic jack 75 through the three strands 81, 82, 83 of the cable 79. As is best seen in the schematic view of FIG. 15, a 22.5 inch stroke of the hydraulic jack 75 will lift a standard trailer bed 67.5 inches to provide a 47 degree dump angle for the trailer bed. The upper pulley 77 maintains constant contact with the cam track 80 throughout the lifting operation, primarily due to the forces exerted by the first and third strands 81, 83 of the cable on the rearward side of the hydraulic jack 75, which is offset only by the force exerted on the second strand 82 forwardly of the hydraulic jack 75. The arrangement depicted in FIG. 15 provides substantially the same moment arm for the lift force exerted on the cable 79 about the dump axis 29 at the top of the stroke of the hydraulic jack 75 with the trailer bed at the maximum dump angle as at the bottom of the stroke with the trailer bed in a transport position.

While the intent of the alternate lift jack assembly 70 described above is to substitute for the bottle jack 40, the trailer 10 would still be able to provide both the tilt and dump functions due to the frame arrangements 20, 30 described above. Removal of the alternate lift jack assembly 70 is preferred if the hydraulic jack 75 would be in the way of hauling a long load on the trailer bed, as opposed to the function of lowering the bottle jack 40 described above. However, lowering the alternative lift jack assembly 70 can also be accomplished if sufficient slack is provided for the cable 79, as the alternative lift jack assembly 70 can be pivoted about the pivot pin 74. It will be noted by one skilled in the art, however, that the height of the pulleys 73, 77 could still present a clearance problem for a long load, which is why a removal of the assembly 70 is preferred.

Referring now to FIGS. 16–18, a screw jack actuator 90 that can be utilized to provide a mechanical assist to the tilt function of a conventional gravity-based tilt trailer is best seen. The screw jack actuator 90 is an inexpensive extensible actuator that, with the other parts defined below, can be marketed as an after-market kit for use with previously existing tilt trailers. The screw jack actuator 90 is extensible and contractible in a conventional manner through operation of a crank handle 91 positioned at the top of the actuator 90. Manual rotation of the crank handle 91 telescopically extends the bottom tip 92 of the actuator 90 which is fastened via a pivot pin 93 to the mounting brackets 57 affixed to the opposing sides of the trailer tongue 12. As a result, the outer casing 94 of the screw jack 90 raises vertically. Since the yoke 50 is attached to a collar 95 fixed to the outer casing 94, and since the legs 52 of the yoke 50 are connected to the mounting members 36, the trailer bed pivots about the tilt axis as defined above to provide the tilt operation for the trailer 10.

The bottom tip 92 is pinned to the telescopic section 96 that extends from the outer casing upon appropriate rotation of the crank handle 91 by a connecting pin 97. When pinned, the bottom tip 92 fixes the telescopic section 96 to the mounting brackets 57 for extension and contraction in a normal manner. Removal of the pin 97 enables the bottom tip 92 to slide relative to the telescopic section 96 irrespective of the operation of the crank handle 91. As a result, the removal of the pin 97 allows the outer casing 94 to freely move relative to the bottom tip 92 which has a substantial length extending into the telescopic section 96. Thus, the trailer bed is free to move with the force of gravity or other external force to effect pivotal movement about the tilt axis. Accordingly, removal of the connecting pin 97 allows the conventional tilt trailer to operate in the conventional manner as though the screw jack 90 were not attached.

The bottom tip 92 is beveled, as is best seen in FIG. 17, to form a cam surface for interaction with the latching mechanism 100. The latching mechanism 100, which can be utilized with the bottle jack actuator 40 described above, is required because the actuator 90 is not stabilized by spaced apart pivots 49, 56 as is described above with respect to the bottle jack 40. The latching mechanism 100 serves as a forward stop apparatus to control or restrict the forward pivotal movement of the actuator 90 and includes a latch plate 101 pivotally supported on the mounting brackets 57 and defining actuating levers 102 that project outwardly and forwardly through slots 103 formed in the mounting brackets 57. The latch plate 101 is formed with a concave cutout 104 that conforms to the size and shape of the bottom tip 92 for engagement therewith to restrict pivotal movement of the screw jack 90 toward the lowered transport position, as is described above with respect to the bottle jack 40. A pair of springs 105 interconnect the opposing ends of the pivot pin 93 with the corresponding actuation levers 102 to bias the levers 102 toward a raised position that interferes with the pivotal movement of the screw jack 90.

A pair of stops 54 limit the rearward movement of the yoke 50 and connected screw jack 90 to prevent the screw jack 90 from tipping rearwardly too far. Accordingly, the screw jack 90 is trapped in the upright operative position between the stops 54 which restrict rearward pivotal movement of the actuator 90 and the latching mechanism 100 which restricts and controls the forward pivotal movement of the actuator 90. Preferably the stops 54 are affixed, such as by welding, to the mounting members 36 and include adjustable heads 54*a*, such as a carriage bolt, threaded into the stop 54 to engage the legs 52 of the yoke 50. The adjustable heads 54*a* permit the stop to be reoriented for proper effectiveness. The latch mechanism 100 serves as a forward stop apparatus to limit the forward position of the screw jack 90 when placed in the upright operative position, thus trapping the screw jack 90 between the latch plate 101 and the stops 54.

In operation, the screw jack 90 (or bottle jack 40) can be lowered to the inoperative transport position by depressing one of the actuation levers 102 to overcome the biasing force exerted by the springs 105. The resulting pivotal movement of the latch plate 101 disengages the cutout 104 from the bottom tip 92 and allows the screw jack 90 to pivotally move about the axis 53 defined by the pivotal connection between the yoke legs 52 and the mounting members 36. Returning the screw jack actuator 90 to the upright operative position is simply a matter of manually raising the screw jack 90. The